RDT&E Management Initiatives in an Age of Uncertainty

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The Department of Defense Research, Development, Test and Evaluation (RDT&E) management tools have evolved through the years. They take the form of formal and informal review procedures, management policies, and new thrusts in key areas. The current area of emphasis are identified as Management Initiatives. Of these, the DSARC process, the Design-to-Cost concept, efforts to improve program management, status reporting to Congress, Independent Cost Analyses, Policies for Specifications and Standards, and Management of Proliferation have a pronounced influence on RDT&E development programs.

DSARC Process

The Defense Systems Acquisition Review Council (DSARC) is effective as a continuous process. The discipline of DSARC is imposed on all major Defense acquisition programs (over $50 million in RDT&E, $200 million in procurement, or of special interest). The process includes a number of formal reviews, in which the thrust is dependent on the particular phase of the program being reviewed.

The first major milestone (DSARC I) focuses on the issue of whether to proceed into advanced development. Here the questions asked about the program address the reality of the military need, the potential of the proposed program to fill that need, the technical risk inherent in the development, and the status of alternative solutions. While approval at DSARC I is a necessary condition to proceeding toward DSARC II, it is not automatically a sufficient one. Interim reviews and conditions are frequently imposed.

The second major milestone (DSARC II) focuses on the issue of whether to proceed to full engineering development. Here the questions asked are more closely related to an ultimate system. While they still critically examine the need, they also address the quality of the cost and performance data that has been developed, the adequacy of the test and evaluation programs, and the maturity of the technology.

By the third major milestone (DSARC III), when the issue of whether to go into production is addressed, the questions focus on force structure requirements, production readiness, producibility, logistics support, and training and manpower needs. Test and evaluation results are carefully analyzed.

Interspersed among the above reviews can be other formal meetings of the DSARC, or less formal Program Reviews, and Development Concept Papers (DCP). There are also continuous support activities bridging the intervals between reviews. Taken in the aggregate, these actions make up a consistent pervasive management process of growing effectiveness. This DCP/DSARC process is now formalized in the DoD Instruction 5000.2.

During calendar year 1974 the DSARC conducted 34 reviews of weapon system programs. These included 21 milestone reviews; the remaining were reviews of program status and/or specific problems.

The DSARC process influences major programs considerably. DSARC members and the Service key officials are devoting greater personal attention to DSARC preparation. The quality of programs which are now being presented for DSARC consideration are markedly better than those which were reviewed during the preceding equivalent time period.

Costs, requirements, alternatives, and management concepts are now more critically evaluated in the Services prior to reaching the DSARC. The Army has even established its own similar review—the ASARC.

There were several instances where the DSARC has recommended modifications to previously planned programs. The Air Force's Air-Launched Cruise Missile (ALCM) Program was held in Advanced Development, directed to be phased with the Navy Submarine-Launched Cruise Missile (SLCM), and required to seek commonality of engine, guidance, and warhead with the SLCM program. The pace of the EF-111 program was slowed, delaying completion of the advanced development phase by one year.

The Army's Surface to Air Missile Development (SAM-D) program was directed to reduce the engineering development phase activity to a minimum, essentially moving back into advanced development, until the critical demonstration of the guidance concept had been accomplished.

The Navy's recommendations for the stretching of the S-3 aircraft to provide a Carrier Onboard Delivery (COD) capability was rejected with the suggestion that other alternatives be considered.

How RDT&E Management Initiatives Help Guarantee Program Success

These and other recommendations were accepted by the Secretary of Defense and formed the basis for direction to the Services. Each action was a prudent management step, minimizing financial exposure until a higher level of confidence in the programs could be established.

In other instances, the DSARC more closely endorsed the previously planned programs. Among these, the Air Force F-15 fighter, the Trident submarine, and the A-10 attack aircraft were approved for production. The Short Range Air Defense (SHORAD) system was approved for full-scale development. Approval for advanced development was given for the CONUS Over the Horizon Backscatter (OTH-B) radar program and the UHF Space Segment of the Defense Satellite Communications System (DSCS III). In these cases, program issues were resolved prior to the formal reviews.

Design-to-Cost (DTC)

DTC is a promising approach to controlling the cost of military equipment by specifying the acceptable (and affordable) cost of hardware. DTC is an evolving management initiative and a dynamic activity.

The overall objective of Design-to-Cost is to achieve the proper balance among life-cycle cost, performance, and schedule. At present the cost data base on operating and support costs is not sufficient for accurate estimates of total life-cycle costs. Therefore, in the initial phases of Design-to-Cost, concentration is on establishing firm goals for average unit production costs, and utilizing the best available estimates to evaluate operating and support costs. This approach is being augmented by establishing DCP thresholds for reliability and maintainability, which strongly influence the support costs.

In April 1974, DoD prepared an extensive report on Design-to-Cost in response to a request by Congress. Since then, the Design-to-Cost concept has been significantly expanded. Design-to-Cost goals are now required for all major programs, and the concept has been extended to subsystems and other-than-major systems. Management and accounting of support costs

The DSARC process is imposed on all major Defense acquisition programs, such as the Army's Surface to Air Missile Development (SAM-D), above, and the Navy's Surface Effect Ship (SES), left and on the cover.

have also been strengthened in order to fill in the cost data gap which prevents establishing life-cycle cost goals. These policies are being formalized in a new DoD Directive.

Current status of Design-to-Cost in major weapons systems is shown in an accompanying chart which covers the 79 programs currently in the DCP/DSARC system. The programs which have been assigned

DESIGN TO COST STATUS
29 JANUARY 1975

CATEGORY	PROGRAM PHASING				TOTAL
	I	II	III		
	CONCEPT FORMULATION	VALIDATION	FULL-SCALE DEVELOPMENT	PRODUCTION	
Major Programs in DCP/DSARC	11	25	24	19	79
Total Programs Reviewed for DTC		25	24	3	52
Programs with DTC Goals Established		8	13	3	24
Programs with Partial Application		2	3		5
Programs Under Review		2	8		10
Programs to have DTC Goal Established by DSARC-II		13			13

Design-to-Cost objectives have firm average unit production cost goals, in specific fiscal year dollars, for a stated production quantity. Maximum benefits from DTC are expected in the programs which have not yet entered the production phase. Some of these programs have already passed into production—beyond where Design-to-Cost could be fully effective. Even these programs will receive constant review and will be managed in accordance with Design-to-Cost concepts, in that individual projects or subsystems within these major programs will have cost goals.

The Design-to-Cost concept is being implemented effectively by program managers and is producing positive effects on many of the newer programs. Design-to-Cost clauses now appear in Requests for Proposals and Contracts, usually in the form of incentives or awards for meeting goals. For example, in both the Army Utility Tactical Transport Aircraft System (UTTAS) and the Navy CH-53 helicopter programs, such incentives were included in the contracts for prototype development. The Navy Low Cost Electronic Warefare Suite is setting an excellent DTC example in conducting comprehensive functional and performance tradeoffs.

Program Management

A basic ingredient in any successful major development program is strong, competent program management. Industrial program managers are carefully selected, especially on major programs. The

Design to Cost goals are required for all major weapons systems and subsystems, including, clockwise from top, the YF-17 fighter, the guided missile hydrofoil, the A-10 close air support aircraft, the Trident submarine, and the Harpoon missile.

proper choice is critical to the success of a program. And good program managers are hard to find.

The impact of the choice of the program manager on DoD programs is equally critical. There have been some very successful program managers, but all too often careful screening has not been undertaken as in the selection process. It was not recognized that a man with a distinguished combat record might not necessarily make a good program manager.

In recognition of the importance of these jobs, two principal steps have been taken to improve the quality of program managers. First, administrative actions have been taken to make this a more attractive career, and second, the formal training of program managers is being emphasized to provide them the proper tools to work the problems.

DoD Directive (5000.23) formalizes the policy for selection, training, and career development of program managers. The primary goal of the effort is to have the DoD components develop career fields in system acquisition management and establish career opportunities to attract, develop, retain, and reward outstanding officers and civilians in this field.

Professional education, training and experience are considered the key to progressive career growth of program managers. To help sustain this growth the Defense Systems Management School (DSMS) provides a basic program management course, executive refresher courses and selected courses in applicable subjects. It is expected that eventually all program managers of major defense systems will have attended one or more DSMS courses.

Selected Acquisition Reporting (SAR)

When DoD and Congress approve the full-scale development of a major weapon system, the Service (and DoD) essentially commits itself to develop and procure a specificed quantity of a system for a defined cost. To provide progress reports on these commitments in major programs, the Services prepare a quarterly SAR (Selected Acquisition Report), delineating the current cost, schedule, and technical information. SARs provide DoD, appropriate Congressional committees, the Office of Management and Budget (OMB) and the Government Accounting Office (GAO) with a standardized tracking system, permitting actual achievements to be assessed against program objectives. When changes occur from one reporting period to another, an explanation is provided in the report.

The objective of these reports is to disseminate essential information on key programs—particularly identifying any deviations from program baselines that

may occur. To be useful, the reports should be timely, accurate, and complete.

DoD has recognized that there is room for improvement in the SARs. Accordingly, a DoD Review Group was established last year under the chairmanship of the Office of the ASD (Comptroller), to review the SAR system and recommend changes. This group was specifically asked to consider changes recommended by Congress and the GAO. As a result of the work of the group, a revision to the SAR instructions is being issued.

Some of the changes planned include expediting the submission of SARs to Congress, establishing an automatic mechanism for initiating SARs (at time of DSARC II approval), adding the Design-to-Cost goal to the report, and clarifying the guidelines for developing and reporting out-year escalation estimates in the SAR.

Cost Realism, Control and Reduction

In attempting to control major Defense System costs, an effective approach is to establish realistic cost goals and then impose discipline to hold to these goals. Both steps in this approach are difficult and complex but they are a *sine qua non* of costs control in big programs.

Establishing cost goals requires the ability to establish costs accurately. The costs of manhours and material which constitute the basic elements for the prices DoD pays for its goods and operating expenses are closely tied to rapid changes in the prevailing economic conditions of our Nation. High, ultra-conservative estimates as well as low, optimistic estimates in determining expected costs for program alternatives must be avoided.

The key source for independent assessment and evaluation of costs is the OSD Cost Analysis Improvement Group (CAIG). Over the last year the CAIG has continued to provide this type of cost assessment for each program which has come under DSARC review, as well as for a number of other activities.

The CAIG review of program costs has not only provided improved visibility of Service estimates but has helped us understand differences between program manager and independent estimates when they arise. The CAIG prepares its own independent estimates of program costs if an additional estimate is required.

In the recently completed Air Force Air Combat Fighter evaluations, the CAIG analysts worked closely with Air Force analysts during source selection, giving added confidence to the cost estimates used in the decision process.

Based on the advice of the CAIG, the DSARC has improved the reasonableness of early cost estimates, assuring that the Secretary of Defense is aware of all cost implications, including such items as prudent contingency reserves. In the past these contingencies have not always been included due to overoptimism. The DCP/DSARC process in conjunction with the CAIG has been able to temper much of this overoptimism in our current programs.

With the appreciation that total life-cycle costs are vital to decision-making, the CAIG has been increasing its activity in the area of operating and support costs. The CAIG-prepared "Operating and Support Cost Development Guide for Aircraft Systems" was issued by the DSARC in May 1974. Guides for other hardware classes are planned.

With respect to operating and support costs, the DSARC will soon include much more stringent requirements for reporting reliability and maintainability goals and related support costs throughout the life of each program. This action will focus increased management attention on these life-cycle costs.

To hold to cost goals, once established, requires dedicated efforts by the program managers. They must use the entire arsenal of management tools available, such as Design-to-Cost, trade-offs between modification of existing equipment and developing new hardware, emphasis on high reliability components to minimize support costs, and introduction of competition where appropriate. Ruthless trading among costs, performance, and schedules must be done. Furthermore, to insure that these tools are effectively applied and that they are achieving the desired results, managers must have access to actual and projected cost reports which are accurate, timely and informative.

The truism that "effective management is a continuous process of setting high standards and striving to achieve them" is particularly applicable to the management of cost. RDT&E intends to maintain pressure on this area.

Design to Cost incentives were included in the contract for prototype development of the CH-53 helicopter.

Policies for Specifications and Standards

Military specifications and standards sometimes contain unrealistic, obsolete or marginal requirements which lead to excessive costs. This problem is being addressed through operation of the Defense Materiel Specifications and Standards Board. This Board will formulate recommendations to the Secretary of Defense on proposed revisions to standardization policies.

Coming to grips with the specifications and standards problems is also being attempted in another way. The Defense Science Board Task Group on the Improvement of Specifications and Standards has been established. Preliminary recommendations to alleviate problems are currently under review.

Management of Proliferation

Whenever DoD creates a new piece of military equipment, it begins an expensive cycle—engineering design, documentation, production tooling and test equipment, factory and Service training, establishment of maintenance depots, etc. When the new hardware fills an important military need, these costs are justifiable, but only if there is no other equipment which can accomplish the job. If other equipment, perhaps with modifications, can be adequate, duplication of many of these costs can be avoided and the potential for savings is substantial. The question of adequacy is often a tough issue to assess. Although objective assessments are made, it is very difficult to resolve the marginal cases.

The problem of insufficient commonality is a pervasive one. It occurs within the Services, between Services, and between Allies (for example, within NATO). It is not only a very expensive problem, but it can have a major impact on military effectiveness, especially in wartime. It has been observed that a 30 per cent increase in NATO force effectiveness could be realized if Allies would implement the recommendations for standardization now under consideration.

There are clear benefits in having common hardware, at least to the extent of being able to interface and exchange equipment. The achievement of commonality (or control of proliferation) is an area of special interest to Congress and a major task for the DoD and the Services.

Congressional concern has been expressed in requests for a study of missile proliferation, a semi-annual report on commonality within NATO and others. Within DoD a number of special reviews have been in progress and several actions have been taken.

Duplication of efforts in development is sometimes warranted, even advantageous, in order to decrease costs through competition, keep options open, or pursue long shots. Duplication is permitted, and in some instances encouraged, up to the point of initiating full-scale development and sometimes—when there are sufficient potential benefits to warrant the expense—right up to the procurement decision. For example, parallel developments were conducted for the Airborne Warning and Control System (AWACS) radar up to the full-scale development decision. A highly visible recent example of duplicate development was in the Light-Weight Fighter Program. In both areas the duplication was highly beneficial.

Nevertheless, there are some problems associated with duplication that require special management attention. First, even recognized duplication must be controlled and adequately coordinated. Second, there is occasionally a tendency for duplicative programs to continue beyond the point where the benefits justify the expenditures—sometimes all the way to actual deployment of duplicate weapons systems.

Such approaches are commonly justified on the grounds of unique Service "requirements." It has been

found that this tendency is particularly prominent with avionics equipment such as airborne communications and navigation developments. The problem, however, is not confined to avionics alone.

Generally speaking, duplication is not a danger in the major systems acquisition programs. The high visibility afforded by the DSARC management process adequately controls parallel developments. Duplication is more of a problem with the smaller value developments which are pursued with fewer formal controls. Even when individual programs within a Service are carefully laid out, Service predilections sometimes prevent the process of inter-Service coordination from working.

In these cases DDR&E must exercise leadership to resolve differences and work to establish best courses of action. Responsibility for implementing proper safeguards against unwarranted duplication is not a new DDR&E function. However, it has been given special emphasis and some noteworthy results have been achieved.

All the Services share needs for similar capabilities in navigation. With the cooperation of the DSARC principals, a DoD Positioning and Navigation Review Committee was established. This committee conducted a detailed inter-Service review of over fifty separate navigation-related programs. While an extensive list of initial recommendations and decisions has resulted from this review, perhaps the most significant accomplishment has been the greatly enhanced exchange of information among the Services. The Service participants have gained a fuller appreciation for their counterparts' programs and requirements. The Services are taking greater initiative, independent of specific DoD direction, to harmonize their programs to achieve operational and cost benefits through cooperation.

Success in the positioning and navigation area has led us to support similar inter-Service reviews of military data link developments and Signal Intelligence (SIGINT) gathering systems. These activities are now receiving attention within DoD and the Services.

In the last year, reviews have been focused on the following more specific areas:

- Air-to-air missiles
- Air-to-ground missiles
- Forward looking infrared sensors (FLIRS)
- Air deliverable mines
- Laser seekers
- Tactical target location systems

These reviews sometimes result in redirection of individual parallel programs to achieve modified—hopefully optimum—consolidation. Sometimes specific efforts are terminated. In all cases the reviews result in improved communications and understanding among the agencies involved, lowering the risk of future inefficiencies. Frequently the potential for enhanced effectiveness through increased cooperation warrants the establishment of a joint Service program, managed by people furnished from more than one of the Services. There are currently some 45 joint programs, and a number of other programs are under consideration for joint management.

The Navagation and Traffic Control (NAVSTAR) Global Positioning System is a notable example of what can be done with a joint program. The introduction and use of NAVSTAR by all the Services is expected to reduce net DoD navigation costs by a significant percentage. With NAVSTAR, a large number of other DoD requirements for navigation systems will be superseded. Requirements, and therefore costs, for non-radio frequency navigational aids (e.g., inertial and Doppler) should be significantly reduced. Furthermore, the existence of NAVSTAR will enhance the performance of weapons and simplify their design.

Two subjects very much allied to the concept of joint programs are:

- Single-Service Programs that have multi-Service interests, and
- Joint Operational Testing Programs.

The single-Service programs having a multi-Service interest are those where another Service is interested in using a variant of the system for another mission, or using a subsystem or component for another weapon. The benefits are economy in RDT&E, procurement and logistic support. Examples of these programs are:

- UTTAS (Utility Tactical Transport Aircraft System). The Navy will utilize the basic Army aircraft in their LAMPS ASW Aircraft System.
- The Navy HARPOON Missile is being considered not only for Navy ship, submarine, hydrofoil and aircraft platforms but also for use by the Air Force on B-52 aircraft.
- The Navy ALQ-99 Jammer Pods modified for improved reliability are to be used in the Air Force EF-111A tactical support jammer.
- The Navy's S-3A ASW aircraft engine, the TF-34, is being used by the Air Force in the A-10 Close Air Support Aircraft, and the Army/NASA rotor system research aircraft.

There are 10 Joint Operational Test Programs under the direction of the Deputy Director for Test and Evaluation. These offer advantages and benefits such as assured coordination and collaboration between interested Services, elimination of duplicate testing, better utilization of test facilities, and early and improved development of interoperability and operational tactics.

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